MAI-2004-01

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION

REPORT OF INVESTIGATION

Surface Nonmetal Mine
(Cement)

Fatal Slip or Fall of Person Accident

January 29, 2004

Thompson Industrial Services (FQM)
Sumter, Sumter County, South Carolina
at
Holcim (US) Inc. Holly Hill Facility
Holcim (US) Incorporated
Mine I.D. No. 38-00014

Investigators

Larry R. Nichols
Supervisory Mine Safety and Health Inspector

Charles E. McDaniel
Mine Safety and Health Inspector

Jose J. Figueroa
Mine Safety and Health Inspector

Michael P. Snyder
Mining Engineer

Wayne L. Maxwell
Mine Safety and Health Specialist

Lewis H. Kirk
Mine Safety and Health Specialist

Originating Office
Mine Safety and Health Administration
Southeast District
135 Gemini Circle, Suite 212; Birmingham, AL 35209
Michael A. Davis, District Manager

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OVERVIEW

Kenneth L. Bell, Jr., laborer, age 24, was fatally injured on January 29, 2004, when he stepped onto an accumulation of hot material that collapsed beneath him.

Bell was assigned to clean the scraper area underneath the roller mill grinding table. For no apparent reason, he left the area and walked about 105 feet into a hot gas supply duct. After he walked to the top of the pile of material, which had crusted over, it broke through and he was buried in hot material up to his waist.

The accident occurred because the victim was untrained in the hazards associated with the cement manufacturing process. He left his assigned work area and went into the duct where hot material had accumulated. Barricades or warning signs had not been posted to prevent entry.

GENERAL INFORMATION

Holcim (US) Inc., Holly Hill Facility, a surface quarry and cement manufacturing plant, owned and operated by Holcim (US) Incorporated (Holcim), was located at 200 Safety Street, Highway 453, Holly Hill, Orangeburg County, South Carolina. The principal operating official was Jeffrey Ouhl, plant manager. The mine normally operated three 8-hour shifts a day, seven days a week. Total employment was 205 persons.

The mine was a multiple bench limestone mine. Material was quarried by bucket wheel excavator, conveyed to a belt wagon, crushed, transferred to a belt conveyor system, and stockpiled in a storage facility.

The limestone was combined with other materials and used at the mine site to produce cement that was sold in bulk and bag for use in the construction industry.

Thompson Industrial Services (Thompson) was contracted by Holcim to clean various areas throughout the plant. Thompson was located at 279 Progress Street, Sumter County, South Carolina. The principal operating official was David Oliver, II, site supervisor. The contractor normally worked one 12-hour shift a day, 6 days a week. Total employment was 12 persons at this site. The victim worked for Thompson.

Environmental Services LLC (Sani-Tech) was also contracted by Holcim to clean various areas in the plant. Sani-Tech was located at 2051 Bainbridge Avenue, Charleston, Charleston County, South Carolina. The principal operating official was Ron Dewitt, environmental sales representative. The contractor normally worked one 8-hour shift a day, five days a week. Total employment was seven persons at this site.

On January 26, 2004, contracting crews from Thompson and Sani-Tech started work at Holcim to clean accumulations of material in the roller mill. The mill had been shut down the previous day to enable the contractors to enter the mill to vacuum and pick up material in and around the grinding table.

Before starting to work, employees for both contractors at the site on the morning of January 26, 2004, received site specific hazard training which included training in the hazards of hot material piles. However, Bell arrived at the site later in the morning and did not attend this training session.

The last regular inspection at this operation was completed on December 18, 2003.

DESCRIPTION OF ACCIDENT

On the day of the accident, Kenneth L. Bell, Jr. (victim) reported to work at approximately 7:00 a.m. He and four other co-workers attended a safety meeting/training session on confined spaces. After the meeting, Bell, Felix Quaye, and Joey Ellington, laborers, were assigned to vacuum material from underneath the roller mill table.

They positioned the vacuum truck and extended a rigid pipe through an inspection door next to the bucket elevator on the eastern side of the roller mill. Approximately 30 feet of flexible 6-inch hose was connected to the rigid pipe to facilitate vacuuming.

At 11:00 a.m., after posting the entry permit and putting their lock in place to identify that workers were present in the confined space, they entered the work area. Bell placed over-sized material (fist to softball-size chunks) in five-gallon plastic buckets while Quaye and Ellington vacuumed raw material. As Bell filled the buckets, he passed them through one of six roller mill hot gas inlet ports out into the adjacent hot gas supply duct to Robert Young, service technician with Holcim, or to one of three Sani-Tech employees contracted to assist with the clean up. The buckets were emptied through an inspection door, to a hopper located outside.

At 12:00 noon, Bell, Quaye, and Ellington signed out on the confined space permit for lunch. At 1:00 p.m., James Edwards, laborer for Thompson, replaced Ellington and the three resumed cleaning the area. Work continued until about 4:00 p.m., when Edwards noticed Bell was missing. He notified Leander Weston, lead man for Thompson. Edwards and Quaye continued working while Weston looked for Bell.

At about 5:15 p.m., Weston notified David Oliver, site supervisor for Thompson, that Bell was missing and that he was unable to find him. Weston obtained a flashlight and he, Quaye, and Edwards began searching for Bell. They looked around the table and entered one of the hot gas supply ducts. After traveling

about 80 feet, they reached the base of a build-up of hot material which sloped upward and extended from underneath the hot gas generator toward the louvered damper. Standing at the wye in the duct work, they pointed a flashlight toward the damper and found Bell buried up to his waist in the hot material.

Edwards immediately went back to the roller mill and summoned help. Employees reached Bell by using wooden boards placed on top of the hot material pile to distribute their weight. Shovels and a rope were used to recover Bell.

The county coroner arrived and pronounced Bell dead at the scene as a result of asphyxia and thermal burns.

INVESTIGATION OF THE ACCIDENT

MSHA was notified of the accident at 9:25 pm., on January 29, 2004, by a telephone call from John Jerrels, human resources representative for Holcim, to Harry L. Verdier, assistant district manager. An investigation was started that day. An order was issued under the provisions of Section 103(k) of the Mine Act to ensure the safety of the miners. MSHA's accident investigators traveled to the mine, made a physical inspection of the accident scene, interviewed employees, and reviewed conditions and work procedures relevant to the accident. MSHA conducted the investigation with the assistance of mine management and employees.

DISCUSSION

Location of the Accident

The accident occurred in a hot gas supply duct underneath the hot gas generator about 105 feet from the victim's assigned work area. A pile of hot material had accumulated in a transition zone of the duct. The build-up of material consisted mainly of partially calcined limestone dust that had been entrained in the hot gas flow from the kiln preheater tower.

When the dust-laden gas flow entered the duct's transition zone after passing through the louvered damper, the increased cross-sectional area caused the velocity of the gas flow to decrease. This, combined with the turbulent gas flow

patterns induced by the hot gas generator, caused some of the entrained dust to settle out of suspension in the bottom of the duct. This dust remained loose and did not pack.

At its deepest point, located directly under the hot gas generator, the material pile accumulated to a depth of about 5½ feet, sloping down to a 4- to 6- inch layer where the ductwork wyed into two ducts. This 4-to-6 inch layer generally covered the bottom of both ducts that supplied hot gas flow to the northern and southern sides of the roller mill. The ramp-like, sloped profile under the hot gas generator was shaped by high velocity gases flowing in the duct during operation. Gases from the hot gas generator entered and merged with lateral flow from the kiln preheater, forming and maintaining the slope. The base of the sloped material at the eastern end of the pile was packed enough by the action of the merging gas streams to permit a person to walk up the slope.

In addition, some light cementitious crusting developed on the surface of the pile as it cooled and drew some moisture from the air. The transition zone of the duct was insulated with refractory material on its inside perimeter. This, combined with the self-insulating nature of the material, kept the mass very hot below the surface. The pile could have been as hot as the 500°C (900°F) gas stream that flowed through the duct under normal operations. In the four days that the operation had been shut down, minimal cooling had occurred deep inside the pile of material, where temperatures at the time of the accident were estimated to be several hundred degrees Fahrenheit.

Weather

Weather on the day of the accident was overcast and cold.

Roller Mill Process

The roller mill, model 60/29/600, was manufactured by Polysius Corporation. The mill incorporated grinding, drying, and high efficiency separation of the raw feed with an output of up to 505 tons/hr. The material entering the mill contained approximately 20 percent moisture and the ground material exiting the raw mill contained less than 1 percent moisture. The majority of the product leaving the mill was finer than 90 microns. This material was transported above by hot gases emerging from under the grinding table and the raw mill hot gas inlet ducts to a dynamic separator above the grinding table. The separator allowed finished material to be transported with the airflow to the main bag house. Oversized material, both coarse dust and chunks, could not be

transported by the hot gas stream. This material fell through the nozzle ring and was returned to the mill feed inlet via the table scraper and recirculating bucket elevator.

The roller mill was part of a plant modernization project that was completed in 2003. At the time of the accident, it was shut down for scheduled maintenance. The new plant had been in operation for approximately 9 months. Since then, two previous maintenance shutdowns had occurred. During one of these shutdowns, a similar accumulation of hot material was removed from the duct area underneath the hot gas generator.

Raw Mill Inlet Duct

The airflow used to dry and transport material at the roller mill was supplied by the kiln system and supplemented by the hot gas generator. Airflow was drawn from the preheater section of the kiln system through an induced draft (ID) fan manufactured by Robinson Corporation and forced through ductwork designated as the raw mill inlet duct.

The airflow entered louvered dampers inside the ductwork located on the western side of the roller mill. A portion of the airflow was directed through suitable ducting to the coal bins. The remaining airflow joined with the airflow from the hot gas generator. The total airflow was split horizontally as the ductworks wyed into two smaller ducts that approached the northern and southern sides of the roller mill. Hot gases were directed to six openings (three from each duct) below the grinding table then up through the nozzle ring.

Contractors

Two contracting crews were scheduled to work in the roller mill to clean up material from the roller mill grinding table and to remove preheater dust accumulations from the roller mill hot gas supply ducts.

Thompson was contracted to remove raw material accumulations and oversized raw material chunks from the scraper area under the roller mill grinding table and from six adjacent roller mill hot gas inlet ports.

Sani-Tech employees were assigned with Holcim employee Robert Young to remove oversized material from the roller mill hot gas supply ducts.

Illumination

There were four sources of illumination in the hot gas supply duct. Electric lights were used by Sani-Tech to illuminate the east end of the hot gas supply duct (closest to the roller mill.) The duct inspection door through which oversized material was being removed from the work areas was located at the western extremity of Sani-Tech's assigned work area, approximately 35 feet from the roller mill table area where the victim was assigned. This inspection door was open, admitting direct light from outside. A tempering air damper was located in the top of the duct on the eastern side of the hot gas generator inlet duct and directly above the base of the material pile. This damper was open, admitting indirect light from outside. An inspection door in the south side wall of the duct close to the louvered damper had been removed, admitting direct light from outside.

In addition, the off-white color of the dust reflected the light that entered from outside. Visibility was adequate even with only a limited amount of outside light shining through the openings in the inspection doors.

Vacuum Truck

The vehicle operated by Thompson employees to remove material under the roller mill was manufactured by Sterling Truck Corporation in August, 2002. It had a gross vehicle weight rating of 62,000 pounds. The truck was equipped with a Super-Sucker® vacuum system manufactured by Super Products Incorporated.

A 6-inch flexible hose was connected at the truck inlet to a rigid 6-inch diameter pipe approximately 20 feet long. The rigid pipe extended through an inspection door next to the bucket elevator on the eastern side of the roller mill. Approximately 30 feet of flexible 6-inch diameter hose was found connected to the rigid pipe underneath the grinding table. The open end was found extended into the roller mill hot gas inlet ductwork.

Training and Experience

On January 26, 2004, Holcim conducted maintenance and site specific hazard awareness training, prior to the contractors starting clean up operations. However, Bell was not present because he had been assigned to another job at a different industrial facility. Early that morning, Bell and two other Thompson employees were re-assigned to work at the Holcim facility. Bell did not receive site specific hazard awareness training prior to being exposed to mine hazards.

Hardhat Sticker

Holcim's policy and procedure to determine if contractor employees received site specific hazard awareness training required contractors to display a sticker on their hardhat. The hardhat stickers showed serial numbers, assigned sequentially to individual contractor employees. The employee's name, training date, and assigned sticker serial number were recorded by mine staff. No training records were provided to indicate that Bell received the required training.

ROOT CAUSE ANALYSIS

A root cause analysis was conducted and the following causal factors were identified:

Causal Factor: The management system lacked depth in that a risk assessment to determine possible hazards, such as accumulations of hot material in the hot gas supply duct, was not conducted prior to assigning contractors to perform work.

Corrective Action: Procedures should be implemented that require risk assessments to be conducted that identify potential hazards in areas adjacent to assigned work areas. Barricades should be erected to prohibit access to areas where hazards may exist.

Causal Factor: The required site specific hazard awareness training was not given to the victim before he was assigned to perform tasks. He worked for four consecutive days without the required training.

Corrective Action: Written policy and procedures should be established to ensure that all persons have received all of the required training. Any potential hazards associated with their tasks or work area should be thoroughly addressed.

Causal Factor: Management's oversight of the contractors' work practices lacked depth in that the victim left his assigned work area and was unable to be located for several hours. The victim was not aware of the hazards associated with accumulations of hot material in the hot gas supply ducts and became entrapped.

Corrective Action: Procedures should be established to ensure that all contractor employees understand any potential hazards associated with their assignments. Management should implement procedures to monitor contractors to continually reassess work progress.

CONCULSION

The accident occurred because the victim was untrained in the hazards associated with the cement manufacturing process. He left his assigned work area and went into a hot gas supply duct. Barricades or warning signs were not posted to prevent entry at all approaches to the hot material in the hot gas supply duct.

VIOLATIONS

Holcim (US) Inc.

Order No. 6111502 was issued on January 29, 2004, under the provisions of Section 103(k) of the Mine Act:

> A fatal accident occurred at this operation on January 29, 2004. A contractor employee who was working with a clean up crew under the table of the raw mill entered a large horizontal duct between the preheater and the raw mill and became trapped to the waist in preheater dust. This order is issued to assure the safety of all persons at this operation. It prohibits activity in the raw mill inlet duct between the kiln I.D. fan and the raw mill until MSHA has determined that it is safe to resume normal mining operations in this area. The mine operator shall obtain prior approval from an authorized representative for all actions to recover and/or restore operations to the affected area.

This order was terminated on February 5, 2004. Conditions that contributed to the accident have been corrected and normal operations can resume.

Citation No. 6119884 was issued on March 4, 2004, under the provisions of Section 104(a) of the Mine Act for a violation of 30 CFR 46.12(a)(1):

> A contract employee was fatally injured at this operation on January 29, 2004, when an accumulation of hot material that he walked on unexpectedly gave way, burying him above the waist. The victim had left his assigned work area and entered the hot gas supply duct.
>
> The mine operator failed to ensure that the victim had received site specific hazard awareness training prior to beginning his assigned duties. The victim worked four consecutive days at the operation without the required training.

This citation was terminated on March 5, 2004. New procedures and policies have been implemented to ensure that all persons coming onto the mine site receive all required training.

Citation No. 6119885 was issued on March 4, 2004, under the provisions of Section 104(a) of the Mine Act for violation of 30 CFR 56.20011:

> A contract employee was fatally injured at this operation on January 29, 2004, when an accumulation of hot material that he walked on unexpectedly gave way, burying him above the waist. The victim had left his assigned work area and entered the hot gas supply duct.
>
> Barricades or warning signs were not posted at all approaches to the pile of hot material that had accumulated underneath the hot gas generator in the hot gas supply duct.

This citation was terminated on March 10, 2004. New procedures and policies have been implemented that address the hazards associated with hot material piles. Barricade tape and warning signs will be placed at all access points to any hot material.

THOMPSON INDUSTRIAL SERVICES

Citation No. 6119883 was issued on March 4, 2004, under the provisions of Section 104(d)(1) of the Mine Act for violation of 30 CFR 46.11(a):

> A contract employee was fatally injured at this operation on January 29, 2004, when an accumulation of hot material that he walked on unexpectedly gave way, burying him above the waist. The victim had left his assigned work area and entered the hot gas supply duct.
>
> The contractor failed to ensure that the victim had received site specific hazard awareness training that was provided by the mine operator prior to beginning his assigned duties. The victim worked at this operation four consecutive days without the required training. This constitutes more than ordinary negligence and is an unwarrantable failure to comply with a mandatory standard.

This citation was terminated on March 9, 2004. On February 8, 2004, the contractor implemented a new training policy with procedures to ensure that all employees receive the required training before performing any work.

Approved by: _____ Date: _____
Michael A. Davis
District Manager

APPENDICES

A. Persons Participating in the Investigation
B. Persons Interviewed
C. Figure 1. Schematic of Roller Mill Inlet Ductwork

APPENDIX A

Persons Participating in the Investigation

Holcim (US) Inc.

Russell L. Wiles	vice president, southeast division
Jeffrey Ouhl	plant manager
John Jerrels	human resources representative
Deborah A. Lightfoot	human resources manager
John Todd	area manager – quarry and raw mill
Robert Young	service technician
George Weathers	operational technician

Ogletree, Deakins, Nash, Smoak and Stewart, P.C.

William K. Doran	attorney

Thompson Industrial Services

Greg Thompson	president
Lewis Thompson	vice president
Kenny L. Hoffa	safety manager
Tommy C. Smith	safety director
David B. Oliver II	site supervisor
Leander Weston	lead-man
Dwayne A. Crawford	vacuum truck operator
Felix Quaye	laborer
James Edwards	laborer
Thomas Blackman	off-site supervisor

McNair Law Firm, P.A.

Jason M. Bradley	attorney

Sani-Tech Environmental Services LLC

Paul Goodsell	president
David Thomas	general manager
Francisco Villareal	laborer
Froyland Ramirez	laborer

Mine Safety and Health Administration

Larry R. Nichols	supervisory mine inspector
Charles E. McDaniel	mine safety and health inspector
Jose J. Figueroa	mine safety and health inspector
Michael P. Snyder	mining engineer
Wayne L. Maxwell	mine safety and health specialist
Lewis H. Kirk	mine safety and health specialist

APPENDIX B

Persons Interviewed

Holcim (US) Inc.

John Jerrels	human resources representative
John Todd	area manager – quarry and raw mill
George Weathers	operational technician
Robert Young	service technician

Thompson Industrial Services

Kenny L. Hoffa	safety manager
David B. Oliver II	site supervisor
Leander Weston	lead-man
Dwayne A. Crawford	vacuum truck operator
Felix Quaye	vacuum operator
James Edwards	vacuum operator
Thomas Blackman	off-site supervisor

Sani-Tech Environmental Services LLC

Franciso Villareal	laborer
Froyland Ramirez	laborer